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REPORT

ON

FOREST INSECT CONDITIONS

CALIFORNIA NATIONAL FOREST

Forest Insect Field Station
Northfork, Calif.
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REPORT ON FOREST INSECT CONDITIONS

CALIFORNIA NATIONAL FOREST.

During the late winter and spring of 1920 high winds of unusual severity blew down a great amount of timber on the California Forest. The greatest losses occurred on the Eel River drainage in the vicinity of Erickson Ridge, Boardman Ridge and Big Rock. The loss due to these windfalls was estimated at twenty five million board feet.

In the summer of 1922 Mr. Woodbury visited this area and reported that an insect infestation of unusual proportions had developed. Later in the summer Forest Supervisor Coffman reported that this condition was prevalent over a very large acreage of the Forest. Arrangements were made with the Bureau of Entomology for an insect control survey.

Fall Survey of 1922

This survey was made by Mr. Miller and Mr. Coffman during the period from October 17 to October 31, 1922. The primary insects responsible were the western pine beetle in the yellow pine and the mountain pine beetle in the sugar pine. The work was characterized by large group killings of 50 or more mature trees in a group. No Ips were noticed during the examination even in the pole stands which were heavily infested in many places with the western pine beetle.

Method and Area Covered

A count of the recently killed trees was made from advantageous points along the route from Log Springs Ranger Station past Black Butte, Alder Springs, Pinnacle Rock Lookout, Upper Lake, Elk Mountain Ranger Station and Hullville to Blabon Ranger Station. In addition a check area of 768 acres was selected on the north slope of Elk Mountain for intensive cruising. This area was cruised by the 100% strip method, the beetle killed trees being marked and mapped.

A total of 113 sections were cruised by the extensive method. The 1922 loss for this area was put at 15,000 M. B. M., 74% of which occurred during the summer of 1922.

Estimate of 1922 Losses

Using the results of the extensive and intensive cruises as a basis the loss per acre on the east side of the forest was placed at 58,695 feet per section and on the west side at 247,428 B. ft. per section. This gave a total loss for the entire forest of 113,000 M.B.M. It was assumed that the loss on the entire west side was about the same as was found on the southern part of the forest. Actual conditions, however, were determined to better advantage in 1923 through reports by Forest Officers. It seems evident that the more severe epidemic did not extend much north of Boardman ridge and that in the areas north of this the losses were probably no heavier than on the east side.

On this revised basis the loss would be as follows:

	No. of Sections	Insect Loss M. B. M.
Southwestern part of forest, with an average loss of 58,695 B. ft. per section	140	34,600
Remainder of timbered area in forest	560	32,800
Total for Forest	700	67,400

Since the total volume of sugar pine and yellow pine on the forest is placed at 3,057,376 M.B.M. an infestation of 67,400 M.B.M. would give the 1922 loss as 2.2% of the total volume.

Causes of the Epidemic

The most striking feature of the situation was the sudden development of an epidemic condition during the season of 1922. On the Elk Mountain Check Area the 1921 overwintering infestation of 25 trees with 54,190 B. ft. suddenly increased during the summer attack to 171 trees with 323,490 B. ft., an increase of 597%. The cause of this sudden increase was not determined. While windfalls totaling 25 million feet blown down in the spring of 1921 may have influenced the increase in the infestation, the general distribution of the infestation thruout the forest, the small emergence from the windfalls and the fact that the principal effect of the emergence should have been felt in the overwintering generation of 1921 rather than in the summer generation of 1922 indicates that the windfalls could not have been more than a contributory cause.

A decline in the epidemic was forecast on the basis of similar situations where the peak of the epidemic is usually reached when the infestation has developed to the point where large groups of 25 or more trees are prevalent.

Recommendations

Control work could not be recommended until a more complete, detailed survey of the entire forest was made. Such a survey was planned for the spring of 1923.

Development During Season of 1923

Funds were not made available for the spring survey as planned on the ground that the low value of the timber would make control work impracticable, even if found advisable from an entomological viewpoint. During the summer reports from forest officers on the area indicated a decided decline in the infestation.

A fall survey was planned to determine the extent of this decline as well as the causes of the sudden rise and just as sudden fall in the infestation.

Fall Survey of 1923

The 1923 survey was made by Mr. Miller, Junior Entomologist, H. L. Person and Entomological Ranger, Morrow. Deputy Supervisor, Derby also assisted with the cruise of the check area. The trip was made by car during the period from October 21 to October 27, 1923.

Area Covered and Methods

Due to the very evident decline in infestation it was decided to limit the survey to an examination of a few general areas spotted extensively in 1922 and an intensive survey of the Elk Mt. Check Area.

One day was spent in extensive spotting around Alder Springs and Summit Spring Hill and three days were spent on the Elk Mountain Check Area. Person spent most of this time studying the causes of the sudden increase and decline in the infestation.

Course of the Infestation

In an area examined around Alder Springs the infestation dropped from 120 trees in 1922 to 4 trees in 1923, or a reduction of 96.6%. On the check area of 768 acres the infestation had jumped from 28 trees (3 more 1921 trees were found on the 1923 cruise) in 1921 to 225 trees in 1923. Only 8, 1923 trees were found, but as they had not all faded, plenty of allowance

was made for late fading trees. This shows an increase from 1921 to 1922 of 700% and a decrease from 1922 to 1923 of 93%.

Reports by forest officers acquainted with conditions in the rest of the forest indicate that this reduction was general, tho possibly not to such an extent as was found on the areas examined.

Causes for the Sudden Rise and Fall of the Infestation

It is evident that a very large number of beetles would be required to cause an increase in an infestation of over 700%. In what is now considered a normal attack we figure an average of 17 beetles attacking and 80 emerging. In a static infestation there is a flight mortality of about 80%. Supposing that there was no flight mortality, an obvious impossibility, the increase would be only 370%. It therefore looks as tho part of the 700% increase must have come from beetles outside of the area.

To determine the increase probable on the area itself a study was made of the emergence from all of the 1921 over-wintering generation trees on the Elk Mountain Check Area. The results of this study are shown under Bark Counts from Elk Mountain, attached to this report. Only 8 such trees were found and the emergence was very light. If the heavy infestation during the summer of 1922 was built up on the area, these overwintering trees must have supplied the necessary beetles for the attack. It is apparent that a light emergence from eight trees could not have been responsible for the attack on 168 trees that were killed during the summer of 1922. This is emphasized by the fact that the attack per sq. ft. on the summer generation trees was very high. Over 40 to the square foot.(See table of bark counts.)

Since the attack did not develop on the area the question is where did it develop. As stated in the memorandum on the 1922 survey, it was at first believed that these beetles bred up in the heavy windfall areas of the spring of 1921.

A partial examination of this wind-blown material showed only a very light attack and emergence of the primary insects D. brevicomis and D. monticolae. Then too, the principal attack on this material should have been in the spring and summer of 1921 in time to produce a brood to attack with the overwintering 1921 generation. If therefore, the windfalls were responsible for the increase,why did it not come during the winter of 1921 rather than during the summer of 1922? It is unfortunate that a more thorough examination of these windfalls was not made in order to get more accurate data on the time and amount of emergence. If time allows this material may still be examined during the fall of 1924, when another survey of the general situation is planned. In some cases down trees, if

unattacked will remain green and subject to attack for a year or more. It is possible that this may have happened in this case.

The only other possible source of this horde of beetles that occurs to the writersis that they might have migrated from yellow pine regions immediately north of the area of infestation on the California. During the 1924 survey an attempt will be made to prove or disprove this theory.

The sudden decline in the epidemic is just as hard to explain as the sudden increase. The bark counts of the 1922 summer brood tree shows that it took a large number of beetles to kill the trees and that the emergence was correspondingly light. In fact on the trees counted, which appeared to be an average tree; the number of beetles that emerged was smaller than the number that attacked. This would bring about a big reduction and the apparently healthy condition of the stand would have helped to break up the epidemic by drowning out large numbers of attacking beetles.

The predators were evidently of no importance in this connection as the number of predators was smaller in the 1922 trees than in the 1923 trees.

A survey of this forest sometime during October, 1924 will be well worth while as it will give valuable information on the course of the infestation and will make it possible to study in more detail the probable causes underlying the unusual conditions found during the course of this infestation.

This survey should include a reoruise of the Elk Mountain Check Area, a general survey of the infested areas of the forest, expecially in the northwest point where no spotting has been done, an examination of the slash windfall material to determine the amount of emergence of primary insects and the collection of increment cores to determine the effect, if any of the vigor of the tree on the epidemic.

Bark Counts from Elk Mt. Check Cruise Area.

1921 Winter Brood Trees - The brood from these trees emerged in the early summer of 1922 causing the 1922, 1st generation loss.

Tree # ?
Attack about normal
Emergence very light from north side. South side well worked by woodpeckers.

Tree #1
Attack normal
Emergence light from bark not worked by woodpeckers
70% of tree worked by woodpeckers.

Trees #24,25.
Attack normal
Emergence heavy in bark not worked by woodpeckers.
90% of bark worked by woodpeckers.

Trees #15,16;17,18.
Attack normal to fairly heavy.
Emergence medium light where not worked by woodpeckers.
70% of bark worked by woodpeckers.

No other 1921, 2nd generation trees were found on the check area. Since it is evident that the emergence from the above trees was not heavy enough to cause the 1922, 1st generation loss, the beetles causing this loss must have come from some other area.

1922 Summber Brood Trees - 21 of these trees were killed on the check area of two square miles.

One tree was selected which appeared to be typical of this group.
This tree was felled and bark counts were made at different heights.
Each bark sample was one foot square.

Sample #	Height	Entrance Holes	Vent. Holes	Exit Holes
1	65'	20	32	32
2	65'	23	38	54
3	40'	19	30	50
4	40'	20	34	54
5	25'	24	29	65
6	10'	18	8	36
	Averages -	20.6		48.5

Since there are on the average, 2.6 beetles to every entrance hole the number of attacking beetles, 53.5, is greater than the number of beetles that emerged, 48.5.
As the normal emergence, per square foot is 80 we have a partial explanation of the sudden falling off of the infestation from 216 1922 trees to 8 1923 trees on the check area of two square miles.

1923 Summer Brood Trees - One tree was felled and examined to show comparison in number of predators, attacking and emerging D. brevicomis adults, with 1922 summer brood trees.

Sample #	Height	Entrance Holes	Vent. Holes	Exit Holes
1	12'	8	15	18
2	30'	8	23	88
3	45'	19	31	115
4	45'	16	35	122
5	60'	16	23	68
6	60'	21	25	108
	Averages -	14.6		86.5

This gives the average number of attacking beetles per Square ft. as 37.9 and average number of emerging beetles as 86.5.

The predators were more abundant on the 1923 tree than on the 1922 tree. Since the number of predators on the 1922 trees was apparently no greater than normal it is doubtful if the predators were responsible for the sudden decrease in the infestation between 1922 and 1923.